


# **The Epidemiology of ADHD:**

## **Prevalence, Natural History & Clues to Etiology**

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A stylized, dark teal silhouette of a mountain range is positioned in the bottom right corner of the slide, extending from the right edge towards the center.

# Outline


- Prevalence of ADHD and how it varies
  - Natural History of ADHD and its impact
  - Etiology of ADHD
    - Can exposures to environmental toxicants cause ADHD?
    - How likely is a gene-environment interaction as an explanation?
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- A stylized, dark teal silhouette of a mountain range is positioned in the bottom right corner of the slide, partially overlapping the background.

# Estimates of Prevalence of ADHD

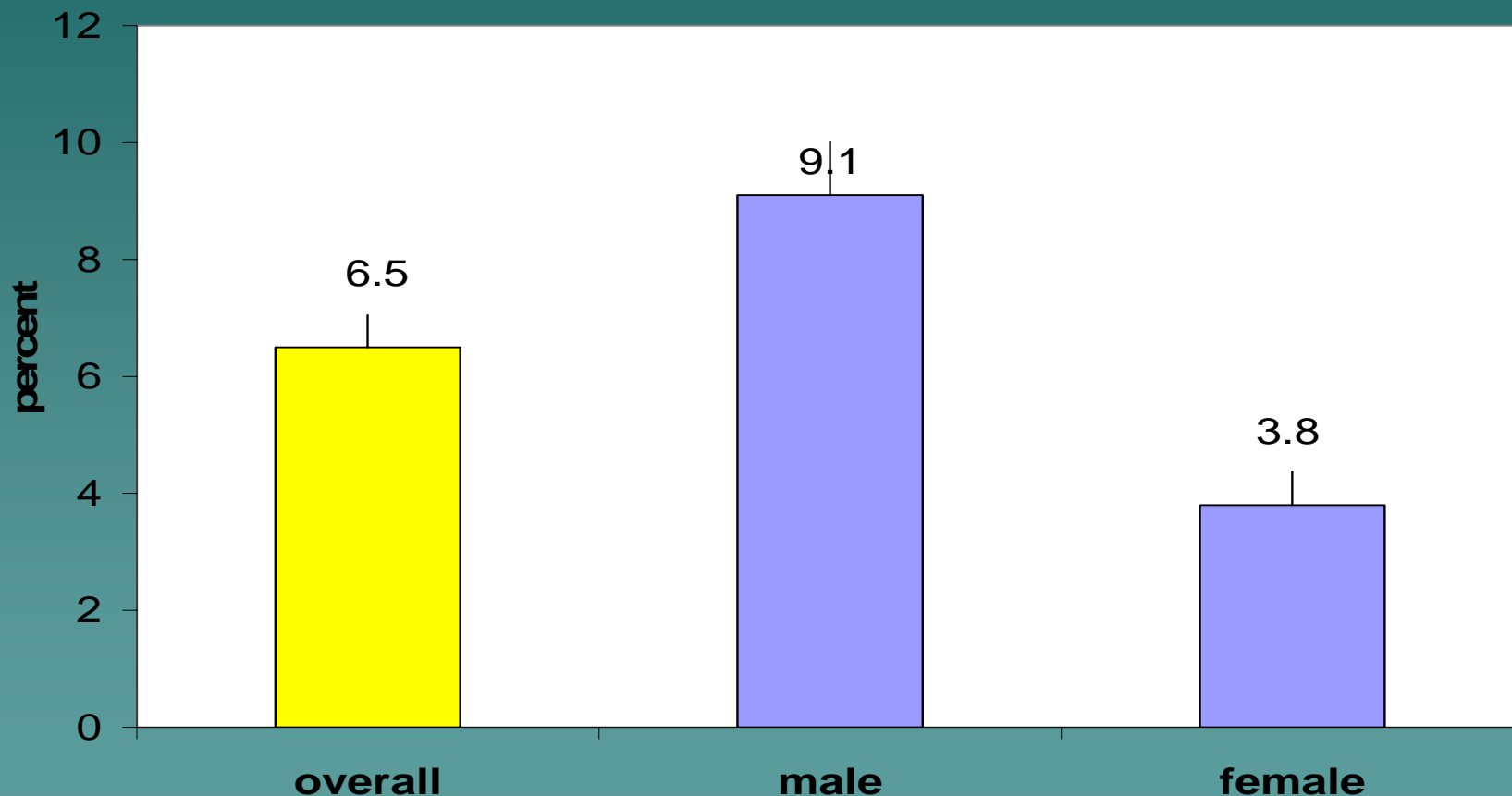
- Prevalence stated in DSM-IV, TR 3-7 %
- Many problems with many current estimates: (Skounti et al 2007)
  - Different definitions of ADHD
  - Clinic samples
  - Use of only 1 informant
  - Children taking medication
  - Symptoms caused by other disorders

# Epidemiologic Compass

Prevalence varies by :

- Gender
  - Age
  - Race/Ethnicity
  - SES
  - Over time
  - Geographically
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# Age-adjusted Estimates of Parent-reported ADHD National Health Interview Survey, 2005

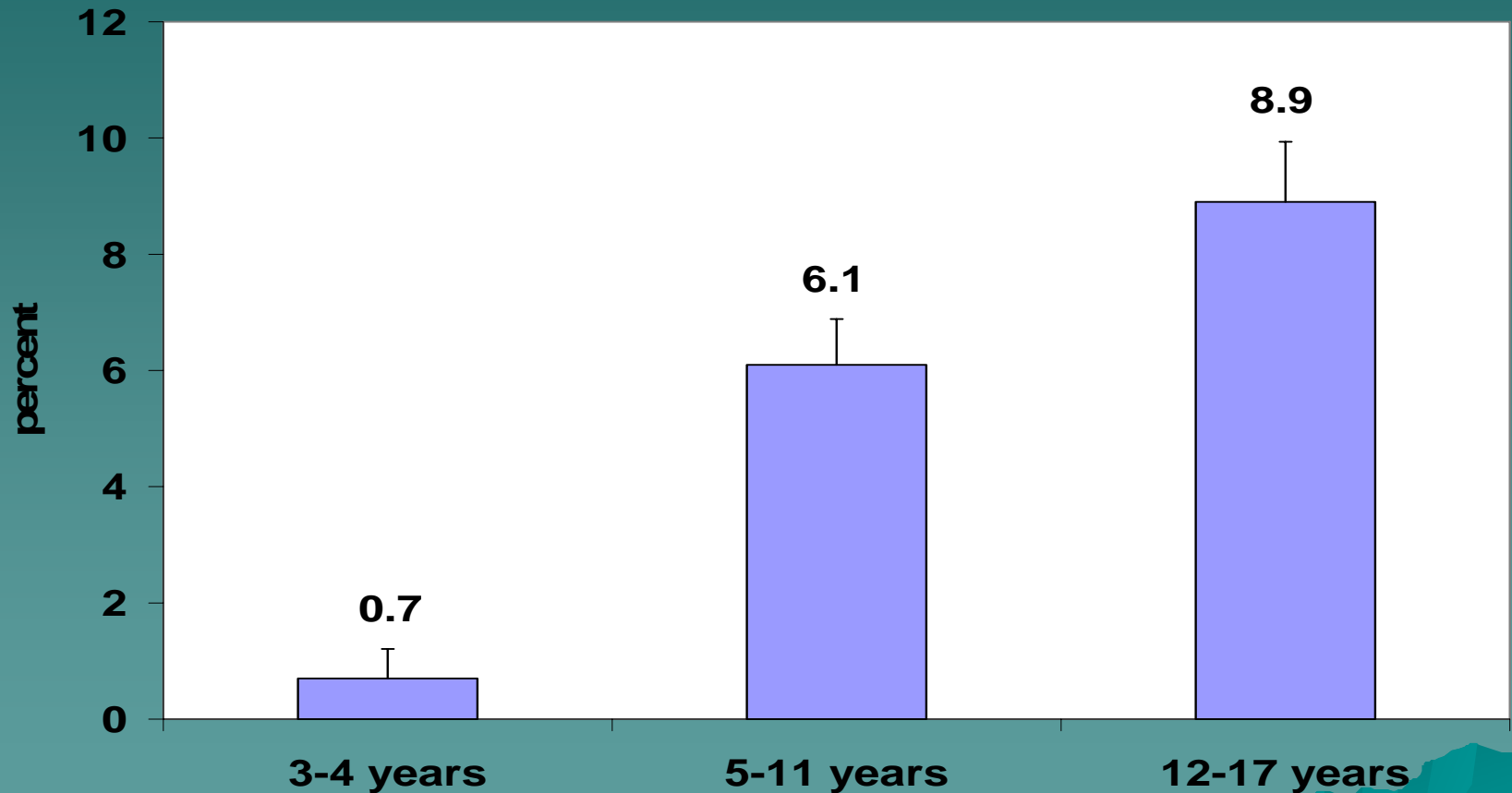


Source: NHIS, Series 10, 231, 2005

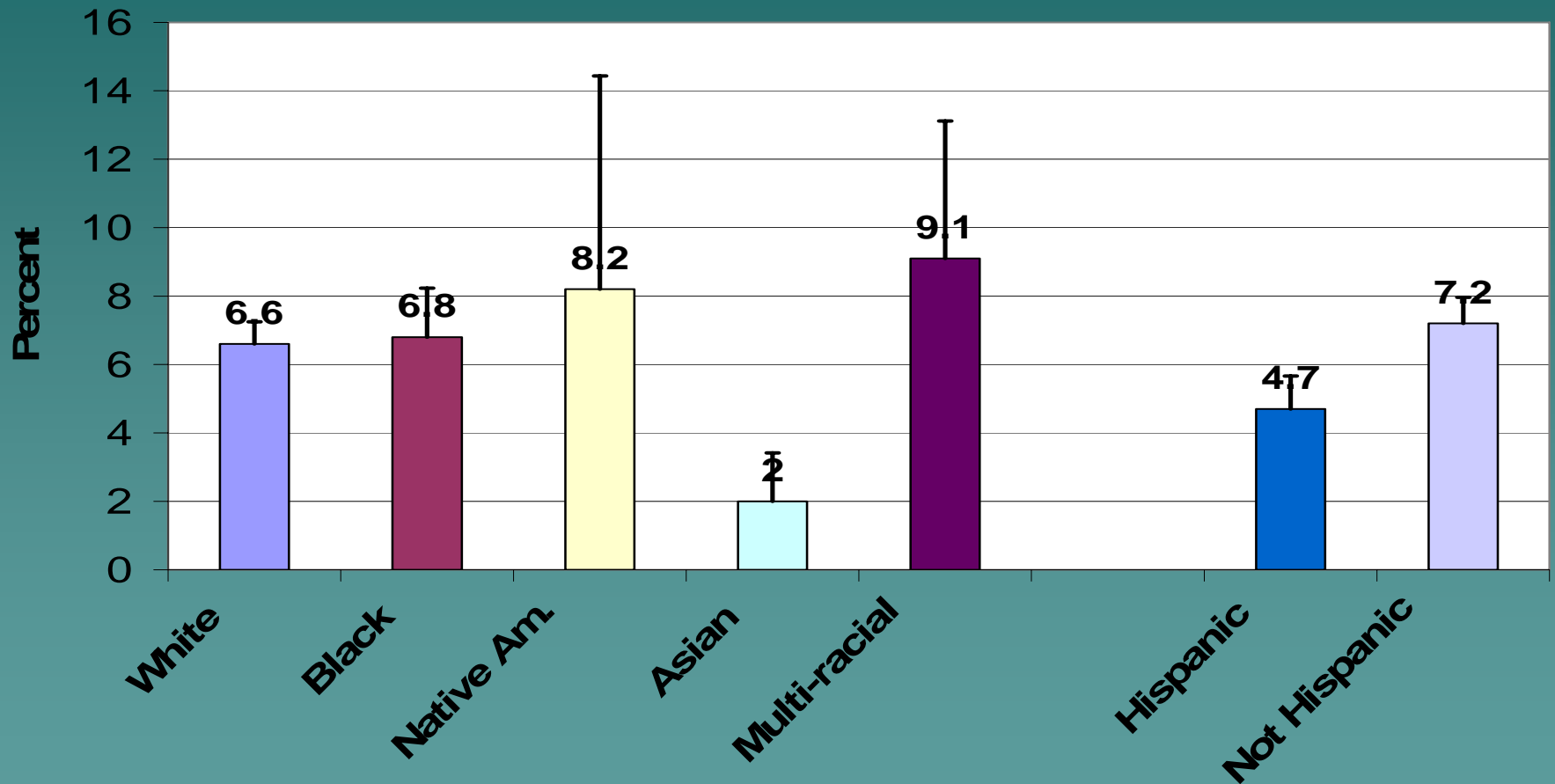
# ADHD as a Developmental Disorder

- Sex ratio for ADHD is about 3:1
- Male predominance true for many developmental disabilities
- Male vulnerability through birth, infancy, childhood

# Relation between Age and Parent-reported ADHD, NHIS, 2005



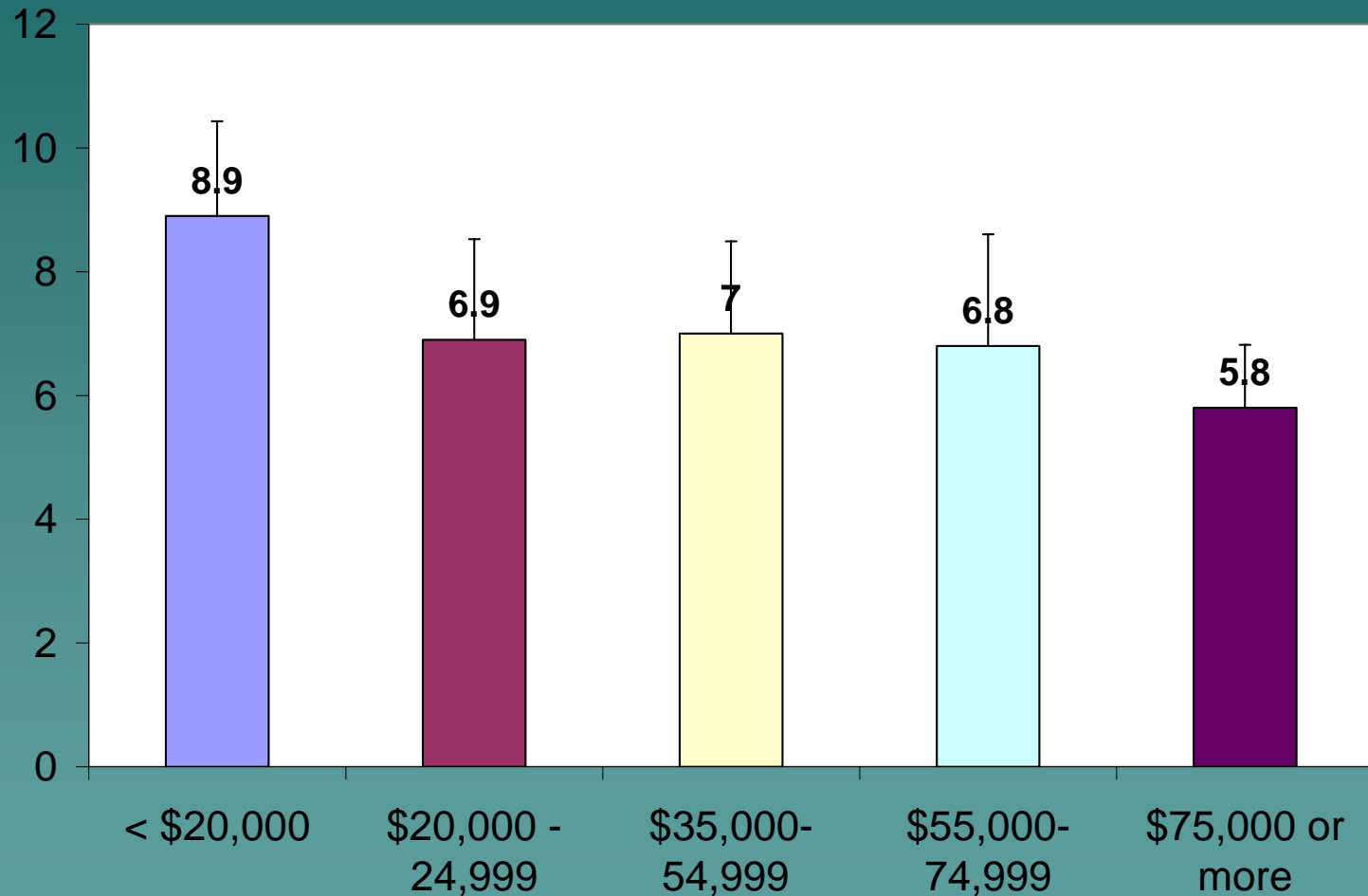
# Age-adjusted Prevalence of Parent-Reported ADHD By Race/Ethnicity



Source: NHIS, 2005

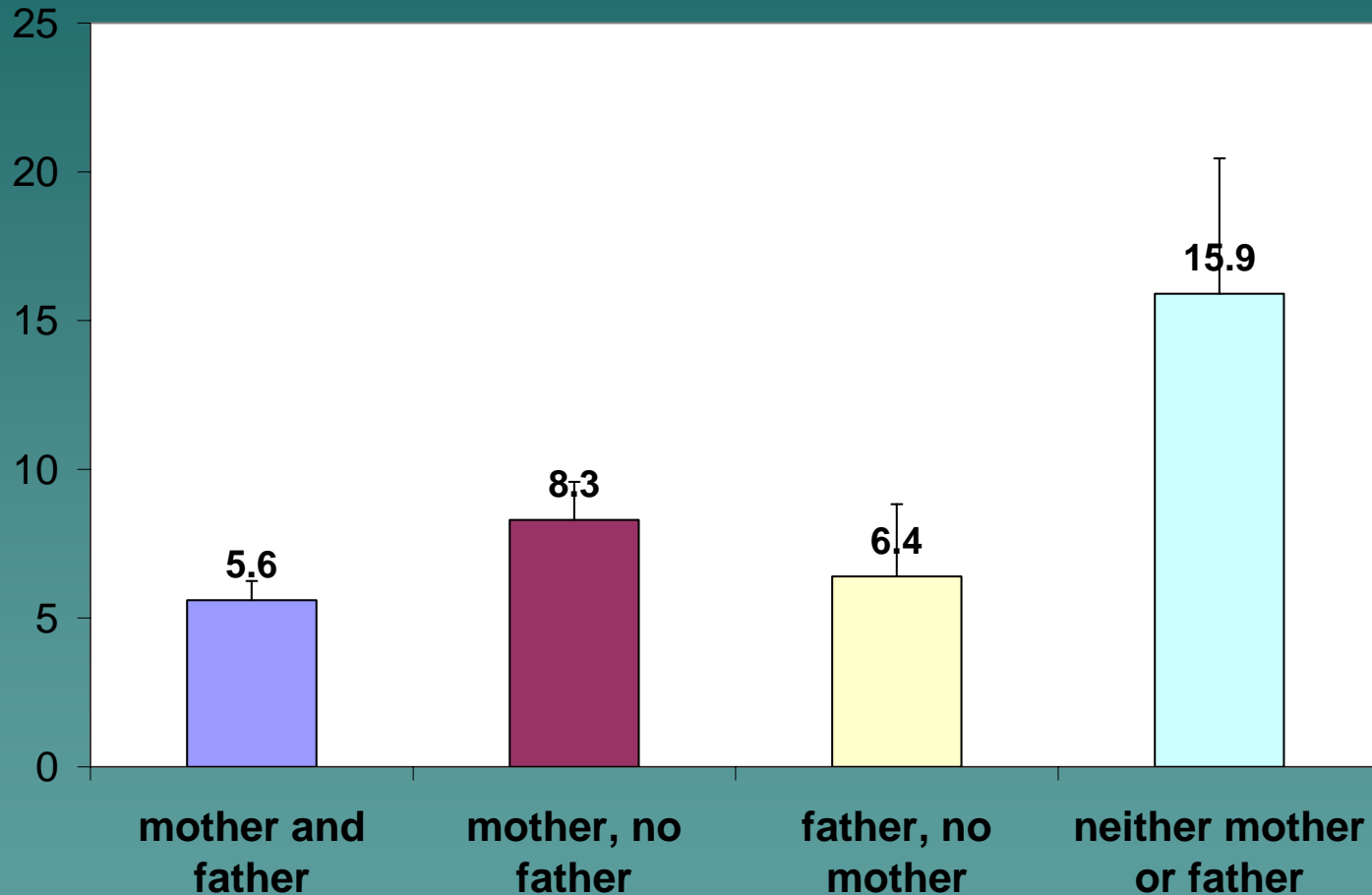


# Age-adjusted Prevalence of Parent-reported ADHD by Annual Family Income



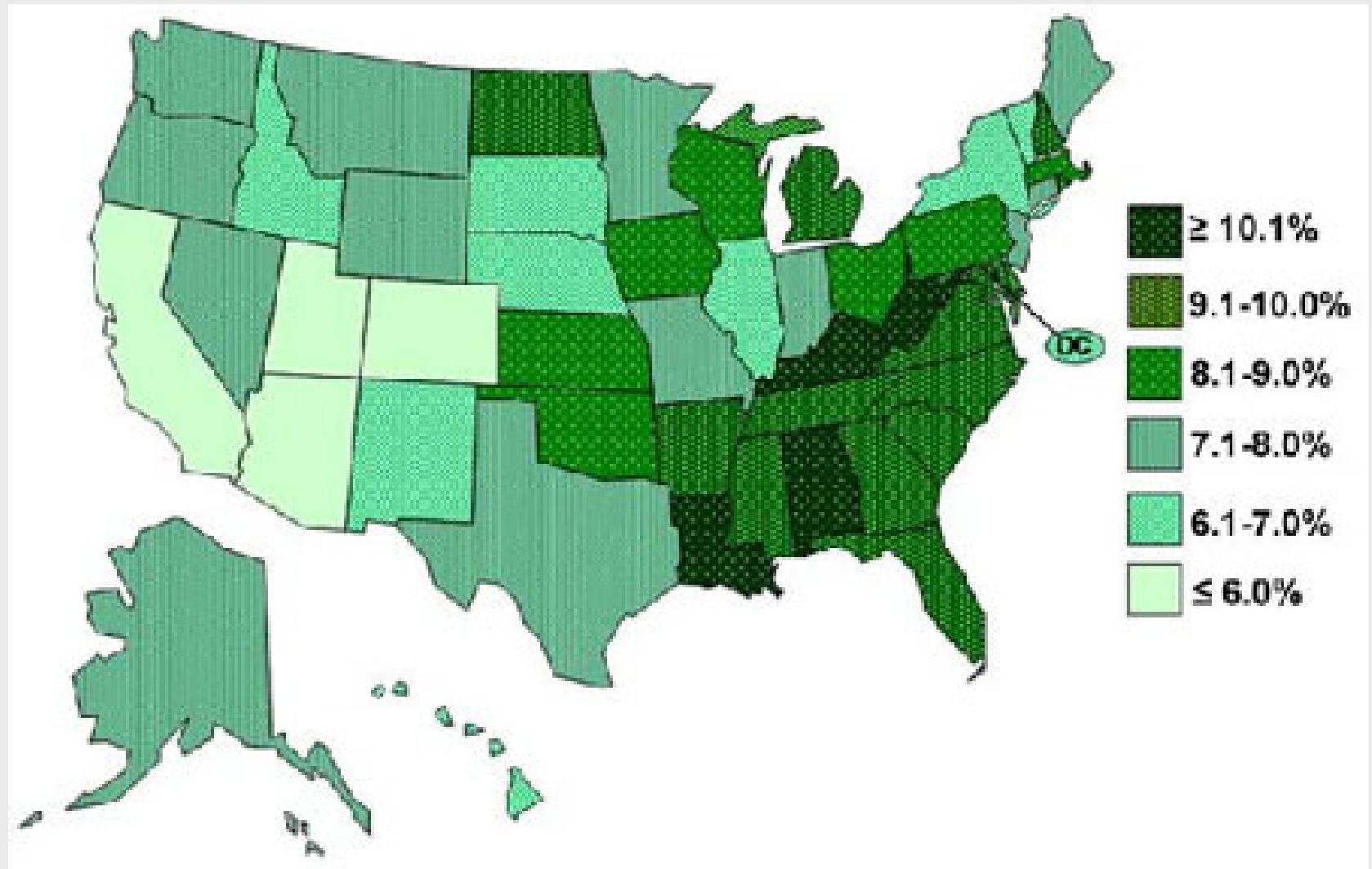
Source: NHIS, 2005

# Age-adjusted Prevalence of Parent-reported ADHD By Family Structure

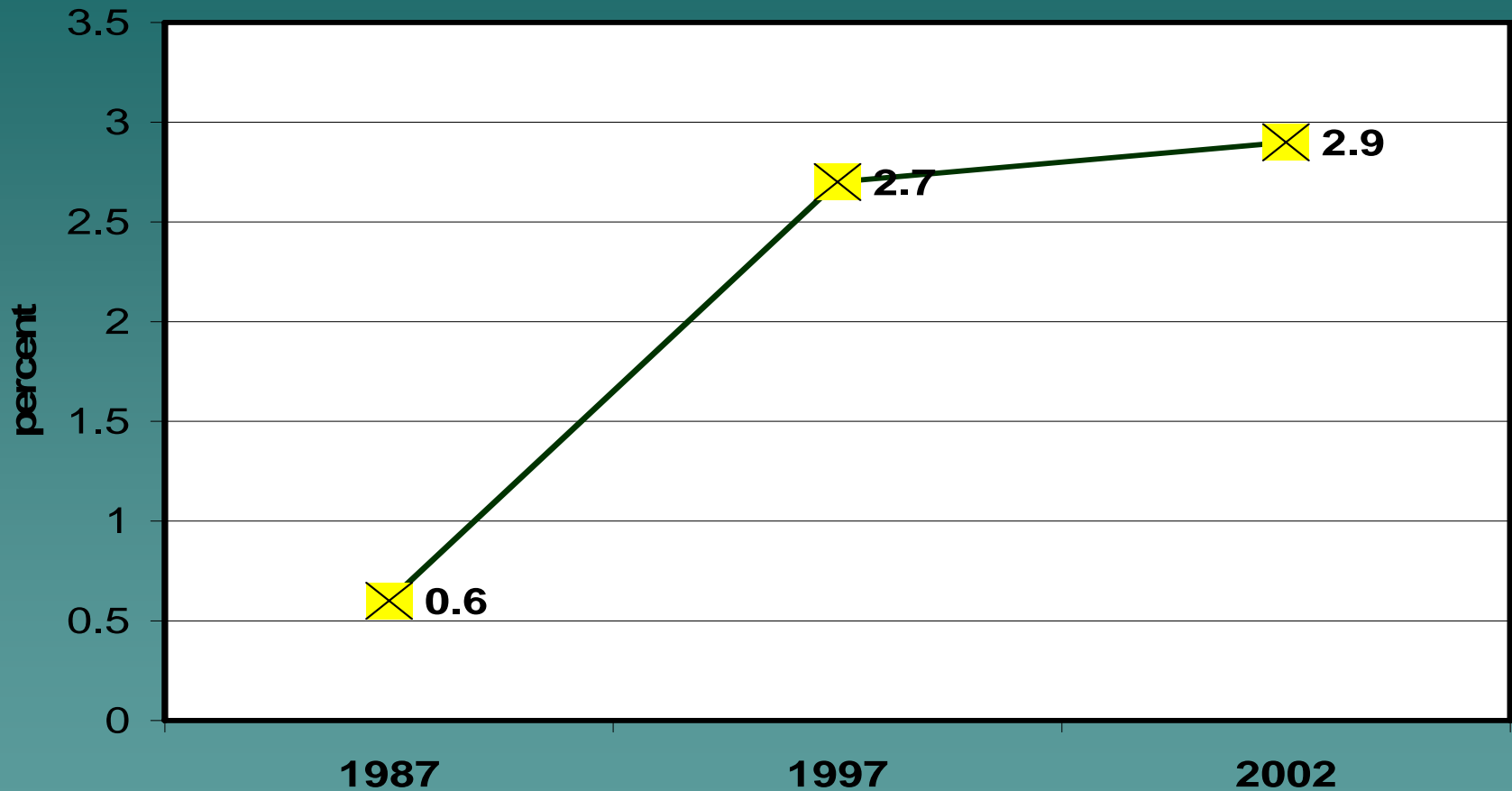


Source: NHIS, 2005

# Prevalence of Parent-Reported ADHD by State, National Survey of Children's Health, 2003



# Prevalence of Stimulant Use U.S. Population - Age 18 and Under



Source: Medical Expenditure Database, AHRQ

# Impact of Natural History



## **Percent of ADHD Children with Comorbid Conditions Ontario Child Health Study**

|                      | <b>% ADHD + Comorbid Conditions</b> |
|----------------------|-------------------------------------|
| <b>Males 4-11</b>    | <b>53.0</b>                         |
| <b>Females 4-11</b>  | <b>42.1</b>                         |
| <b>Males 12-16</b>   | <b>36.9</b>                         |
| <b>Females 12-16</b> | <b>67.0</b>                         |

**Source: Szatmari et al. 1989**

# Natural History of ADHD

*Follow-up studies suggest:*

- 30-45% will meet criteria for ADHD at age 20
- Risks persist
- Risk of substance abuse and conduct disorder

# Accidents and Health Risk behaviors

- **Long term costs** (Discala et al. 1998)  
    Accidents  
    Health risk behaviors
- **Youth with ADHD + Conduct Disorder at particularly high risk**



# Etiology




# Genetic Risk of ADHD

## Farone et al. 2005


- Familial risk
  - Heritability estimates
  - Many polymorphisms, weak relationships •
- May suggest gene-environment interaction

# Pregnancy Complications: Collaborative Perinatal Project 1959-1965

Risk of hyperkinetic-impulsive Behavior

- Prenatal smoking
  - Hospitalized during pregnancy
  - Convulsions during pregnancy
  - Breech delivery
- 

# Toxicant Exposure and ADHD

- Prenatal exposure to smoking
  - Environmental tobacco smoke
  - Prenatal exposure to alcohol
  - Prenatal stress
  - Lead
  - Pesticides
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- A stylized silhouette of a mountain range in a darker shade of teal, located in the bottom right corner of the slide.

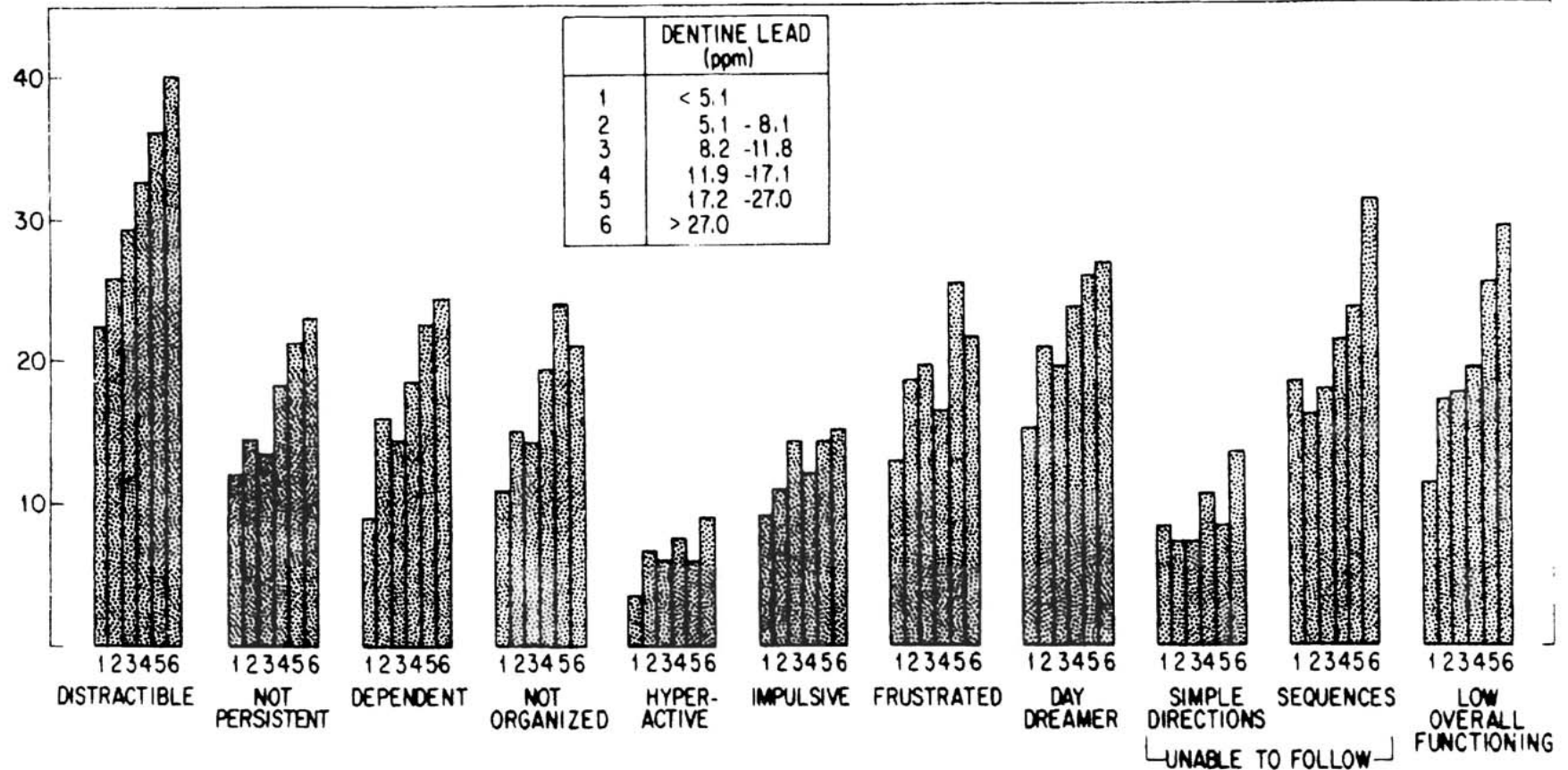
# Prenatal Smoking and ETS

- Prenatal smoking
  - 2003 review (Linnet et al 2003)
  - evidence mixed, but overall positive
- Environmental tobacco smoke
  - evidence mixed

# Prenatal Alcohol / Prenatal Stress

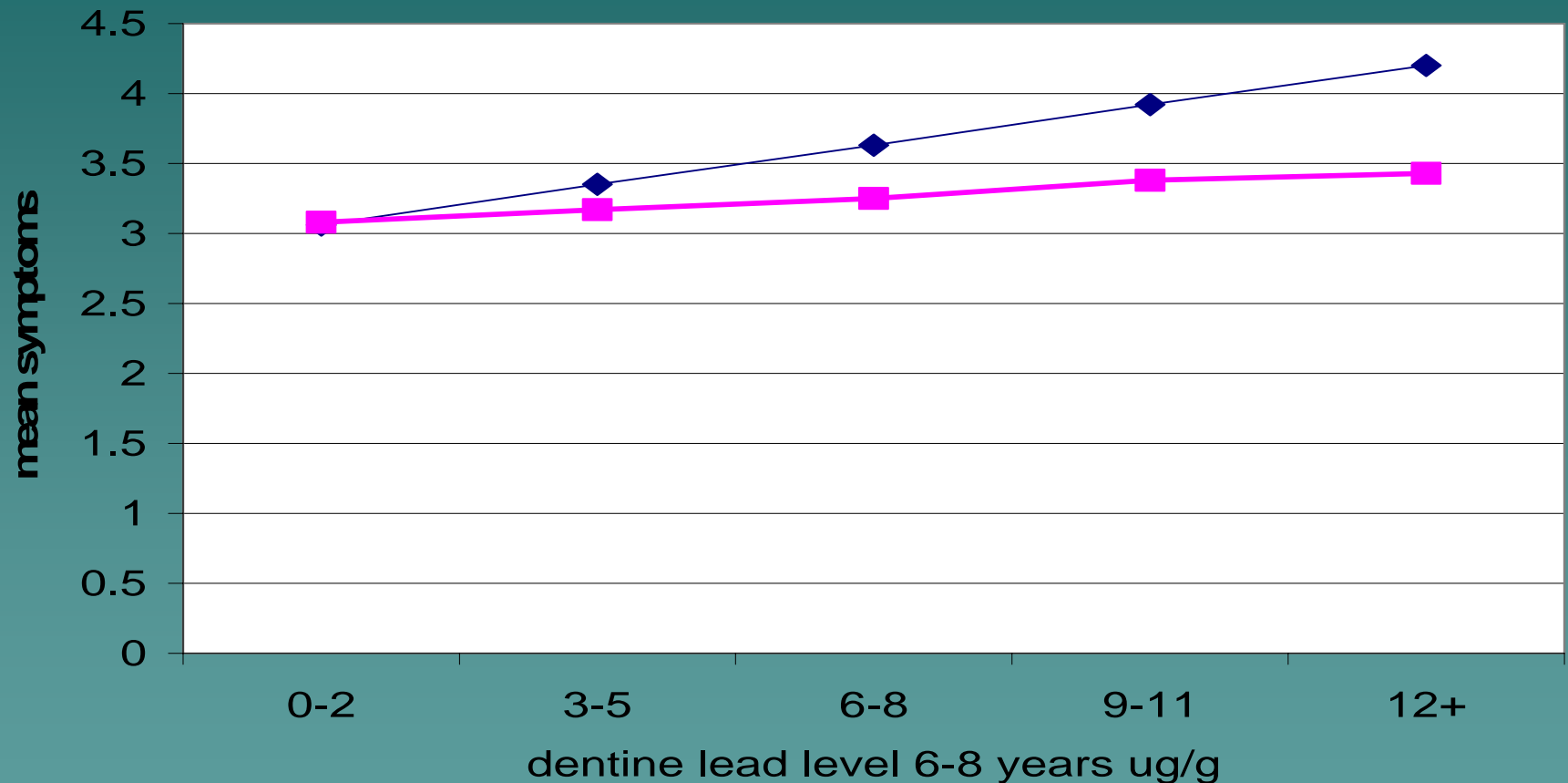
- Nine studies reviewed (Linnet et al, 2003)
  - Evidence mixed
  - Critique comparing ADHD and FAS/FAE
- Implications for environmental studies
- Prenatal stress and ADHD (O'Connor et al 2002, Rodriguez 2005)

# Dentine Lead and Teacher-Reported School Problems



Source: Needleman et al. 1979. N EJ

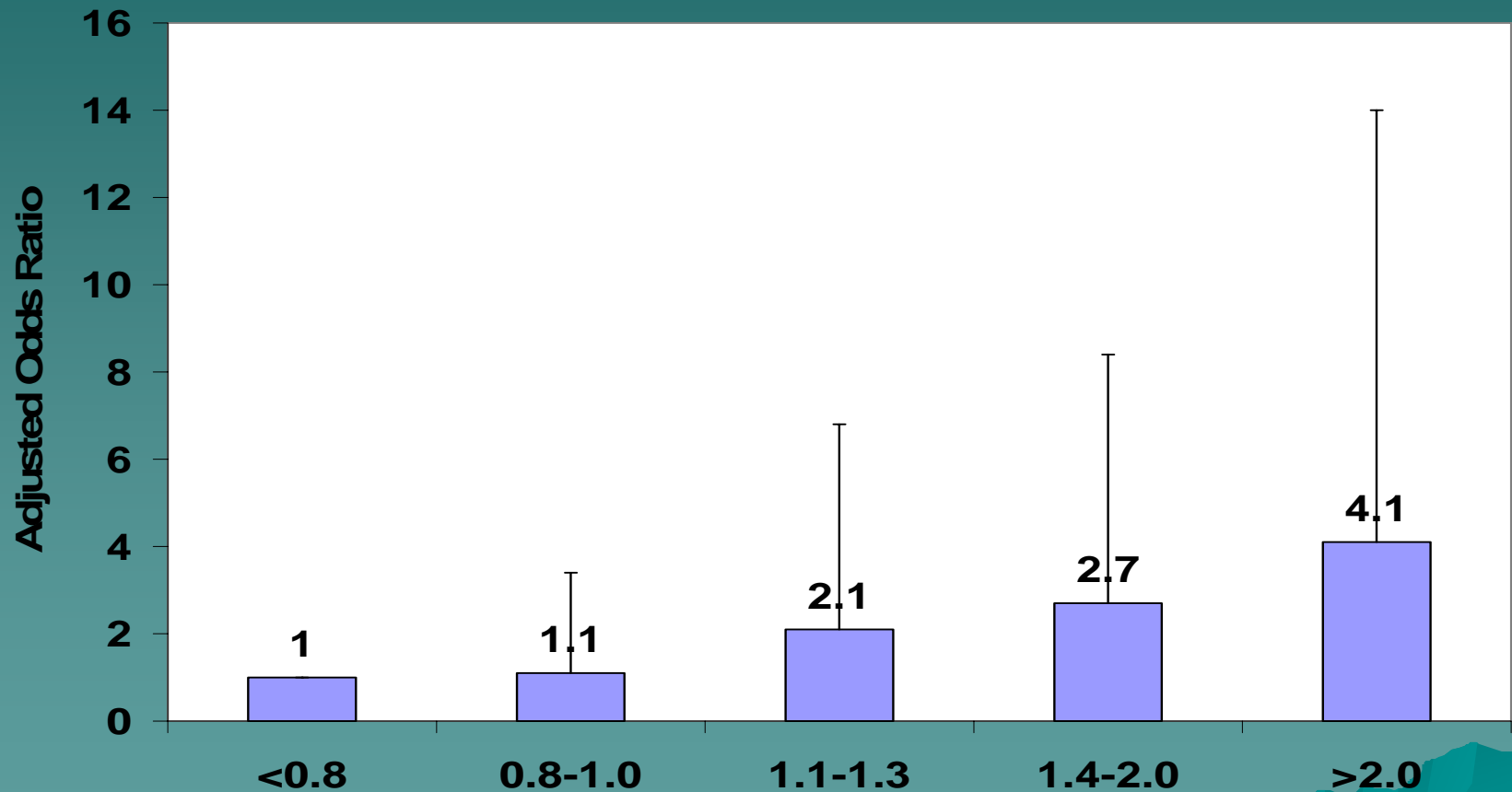
# Relation between Dentine Lead Levels at Age 6-8 and Adjusted Symptoms of Inattention/restlessness at Age 12-13



Source: Fergusson et al. 1993



# Relation between Blood Lead and Odds Ratio for ADHD, NHANES 1999-2002




Source: Braun et al. 2006

# Adjusted Odds Ratios of Attention Problems at 36 months


| Prenatal Exposure           | Attention Problems | ADHD Problems  |
|-----------------------------|--------------------|----------------|
| Environmental Tobacco Smoke | 2.8 (0.4-17.8)     | 8.1 (1.2-54.7) |
| Chlorpyrifos                | 11.3 (1.8-71.0)    | 6.5 (1.1-38.7) |

Source: Rauh et al. 2006

# Points to Consider

- Does the endpoint matter?
    - Tests of attention, ADHD symptoms, or ADHD
    - Multi-method approaches
    - Standardization of the case definition
  - How can we incorporate social factors into our studies of environmental and genetic risk factors?
  - We need to develop more effective ways to control for SES and poverty in our models.
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- A stylized, layered mountain range graphic in shades of teal and blue, located in the bottom right corner of the slide.

# Points to Consider Continued

- Need for more complex models that account for adverse life events and timing of exposures during different stages of child development.
  - Epidemiologic tools don't work very well at low exposures. We need to make good use of the tools we do have.
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- A stylized silhouette of a mountain range in a darker teal color, located in the bottom right corner of the slide.

# Collaborators

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# Bibliography

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